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INSTRUCTIONAL OBJECTIVES FOR A JUNIOR COLLEGE COURSE IN BIOLOGY (FIRST SEMESTER)

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BIOLOGY OBJECTIVES: SET # 1

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Topic I-1. The Ways of Science

Science will be considered as a human activity, motivated by our curiosity to understand the world we live in and by a practical need to master our environment. The phenomenon of life will be considered from a philosophical point of view.

Goal 1: The student will understand the basis of the science of biology.

Obj. 1: Given 5 multiple choice questions covering the definition and subdivisions of biology and the scientific method the student will answer all of them correctly.

Goal 2: The student will understand the definition of life.

Obj. 1: The student will be able to list and define the characterisitcs of a living organism with 80% accuracy.

Obj. 2: Given the two philosophies concerened with the nature of the forces which are responsible for the phenomenon of life the student will match the philosophy to the correct school of thought with 100% accuracy.

Topic I-2. Cells and Cell Division

The cell will be considered as the minimum unit of organization that is alive. The structure and reproduction of cells as well as the organization of cells into tissues will be discussed.

Goal 1: The student will understand the anatomy of the cell.

Obj. 1: Given a diagram of a typical cell the student will be able to label the parts shown with 80% accuracy.

Obj. 2: Given a list of ten structures found in cells the student will state if they are found only in plants, only in animals, or in both animals and plants. 70% accuracy.

Goal 2: The student will understand the process of cell division.

Obj. 1: Given a stage in mitosis the student will diagramatically show the chromosomes, cell wall, and nuclear membrane of the cell as they appear at that stage in mitosis with 80% accuracy.

Obj. 2: The student will be able to answer five multiple choice questions about the process of mitosis. Three out of five must be correct.

Goal 3: The student will understand cellular differentiation into tissues.

Obj. 1: Given five multiple choice questions on plant and animal tissues the student will be able to answer 3 correctly.

Obj. 2: Given the description of a tissue, the student will state if it is of plant or animal origin, and into which of the major catagories of plant and animal tissue types it falls. 50% accuracy.

Topic I-3. The Physical Bounds of Life

Those factors in the physical and chemical world which influence the cell as a living organism will be considered.

Goal 1: The student will understand basic chemistry.

Obj. 1: Given 10 multiple choice questions concerned with structure of the atom, the elements of living organisms, energy of chemical bonds, and the characteristics of an organic molecule the student will answer 7 correctly.

Goal 2: The student will understand the role of inorganic molecules in the cell.

Obj. 1: The student will list and explain the five characteristics of water which make it an ideal media for life (70%).

Obj. 2: The student will list five elements which are necessary for life. 100% accuracy.

Goal 3: The student will know the characteristics of the major organic constituents of protoplasm.

Obj. 1: Given a group of 5 chemical structures and a list of the types of molecules that the structure represents the student will match the structure with its appropriate name. Three correct.

Goal 4: The student will understand physical phenomena which influence the cell.

Obj. 1: Given 5 multiple choice questions concerned with physical phenomena of colloids, suspensions, emulsions, osmosis, and diffusion the student will answer 3 correctly.

Obj. 2: Given information concerning a cell and the environemnt from which it came the student will determine what will happen osmotically and structurally to the cell when it is placed in a new specified environment. 75% accuracy.

Topic I-4. Molecular Biology

Chemical energy derived from the breaking down and building up of molecules as the energy used by the cell will be considered. The cells energy exchange process will be considered as a self sustaining system regulated by enzymes.

Goal 1: The student will understand how energy is derived from chemical reactions.

Obj. 1: Given 5 multiple choice questions on the basic concept of how energy can be released from or stored in a molecule the student will be able to answer 3 correctly. Questions will cover energy of chemical bonds, oxidation, reduction, and enzymes.

Goal 2: The student will understand how energy is stored and released by the cell in form of complex molecules.

Obj. 1: Given 10 multiple choice questions concerned with photyosynthesis, respiration, and the from of energy supplied by these reactions the student will answer 7 correctly.

Goal 3: The student will understand the relationship of photosynthesis, respiration, and the sunthetic pathways involved in the synthesis of fats, proteins, and polysaccharides.

Obj. 1: The student will be able to show graphically the relationship of glucose to the synthsis of fats, proteins, and polysaccharides. 60% accuracy.

Topic I-5. Coding the Mechanism

The method by which the cell stores the information necessary to code and direct the biochemical pathways, and the mode in which this information is read and utilized by the cell in producing the enzymatic proteins that run the biochemical pathways is discussed.

Goal 1: The student will understand the structure, functions, and mode of replication of DNA and RNA.

Obj. 1: The student will be able to list the major constituents of DNA and RNA and diagramatically show the structure of the molecules (60%)

Obj. 2. The student will in 25-50 words differentiate between the function of DNA and RNA as they relate to the regulation of cellular processes. (100% accuracy)

Obj. 3: Given 5 multiple choice questions on the mode of replication of DNA and RNA the student will answer 3 correctly.

Goal 2: The student will understand the role of DNA and RNA in coding enzymes.

Obj. 1: Given a paragraph concerned with the mode by which RNA is produced from DNA and how RNA functions in coding enzymes, in which key words are missing, the student will supply the correct missing word. There will be 10 blank spaces, and 80% accuracy is expected.

Topic I-6. Reproduction: Life Cycles and Meiosis

The continuity of life is dependent on the universal ability of organisms to reproduce thmselves either sexually or asexually. The study of reproduction must reveal the nature of the information that controls the development of the organism, and how copies of this information are transmitted from generation to generation.

Goal 1: The student will understand the process of sexual reproduction as it occurs at the cellular level.

Obj. 1: Given 10 multiple choice questions concerning meiosis, oogenesis, gametogenesis the student will answer 7 correctly.

Goal 2: The student will understand reproduction as it takes place in the organism.

Obj. 1: Given 5 multiple choice questions concerned with the reproductive cycle in plants and animals the student will answer 3 correctly.

Obj. 2: Using the human as an example the student will asnwer 7 out of 10 multiple choice questions on the human reproductive cycle.

Topic II-1. The Particulate Theory of Inheritance.

The field of classical genetics will be discussed as a means of understanding how characteristics are passed onto and segregated among offspring.

Goal 1: The student will understand the principles of Mendelian Inheritance.

Obj. 1: Given 5 multiple choice questions on independent assortment of genes, dominance, and recessivness the student will answer 7 correctly.

Obj. 2: Given 5 multiple choice questions involing one character and two character cross problems in genetics the student will get 3 correct.

Obj. 3: The student will be able to work one-character and two character cross problems in genetics.

Goal 2: The student will understand the role of the chromosome in genetics.

Obj. 1: Given 5 multiple choice questions involving the relati nships between crossing over, linkage, and meiosis the student will answer 7 correct.

Topic II-2. Genetic Aspects of Some Human Problems

Using the principles of inheritance already discussed the field of human genetics will be considered from a quantitative point of view.

Goal 1: The student will understand inheritance in the human as it related to inherited physical traits and to disease.

Obj. 1: Given 5 multiple choice questions on the inheritance of human characters such as blood groups, hair color, skin color, and eye color the student will answer 3 correctly.

Obj. 2: The student will be able to work 2 problems in human genetics. Given the genotypes of the parents the student willdetermine the genotypes of the offspring (50%).

Obj. 3: Given the blood group phenotypes of a mother and child the student will determine out of a list those persons who could and those who could not be the father (70%).

Obj. 4: Given a pedigree of a family the student will determine the mode of inheritance that is involved and be able to tell the genotypes of the selected individuals (60%).

Topic II-3. Sex and Cytogenetics

The role of the chromosome as a unit of inheritance will be considered. The effect of the chromosome in sex determination and the effects of complete and incomplete sets of chromosomes in the organisms will be discussed.

Goal 1: The student will understand sex determination and sex in plant and animal kingdoms.

Obj. 1: Given 5 multiple choice questions concerning sex determination, sex lined characteristics, and the phenomenon of sex in plants and animals the student will answer three correctly.

Goal 2: The student will understand the efffects of complete and incomplete sets of chromosomes in the organism

Obj. 1: Given 5 multiple choice questions concerning nondisjunction and polyploidy in animal and plants the student will answer 3 correctly.

Topic II-4. Populations of Genes and Evolution

The genetics of populations will be considered with emphasis on the idea of the gene pool of variation, genetic equilibrium, evolution as a departure from genetic equilibrium, mutation, and non-random reproduction leading to changes in genetic equilibrium.

Goal 1: The student will understand the Hardy-Wienberg law.

Obj. 1: Given two problems in population genetics the student will calculate the gene frequencies or ratios after mating (50%).

Obj. 2: The student will answer 5 multiple choice questions on population genetics involving the Hardy-Wienberg law. 3 correct.

Goal 2: The student will understand the process by which evolution takes place in a population as a change in genes and genetic frequencies.

Obj. 1: The student will list and dfine the major factors that influence changes in genetic equilbrium of a population which therby lead to evolution. (70%).

Obj. 2: The student will write a 100 word essay on the role of mutation in evolution. (75%).

Obj. 3. The student will answer five multiple choice questions concerned with natural selection and populations of genes (3 correct).

Goal 3: The student will understand the differences in races of man as differences in gene frequencies .

Obj. 1: Given a list of 10 racila characteristics the student will selecte those which are due to simple differences in genes in one population as compared to another (70%).

Topic II-5. Interaction of Heredity and Environment

The relationship of genes to the environemnt will be considered. Examples of human genes, and other plant and animal genes, will be considered with reference to the environment.

Goal 1: The student will understand the selective value of certain genes in certain environemnts.

Obj. 1: Given 5 multiple choice questions on gene adaptations to the environemnt the student will answer 3 correctly.

Goal 2: The student will be able to apply basic genetic and environemental considerations to race problems.

Obj. 1: Given a racial characteristic of a population whereby people are easily differentiated into groups the student will write a 50 word essay explaining why that character was selected for in the natural environemnt of that person (70%).

Topic III-1. Plants

The characteristics of plants will be discussed with considerations on their morphology and classification. The structure of a complex plant will be considered.

Goal 1: The student will understand the types of plants in plant kingdom.

Obj. 1: Given ten multiple choice questions on the evolution, classification, and relationships of plants to one another the student will answer 7 correctly.

Obj. 2: Given five multiple choice questions on the characterictics of plants which differentiate them from animals the student will answer three correctly.

Goal 2: The student will understand the basic morphology of higher plants.

Obj. 1: Given ten multiple choice questions on the general morphology of plants the student will answer 7 correctly.

Obj. 2: Given a diagram of a part of an angiosperm (leaf, stem, or flower) the student will label all of the designated parts with 70% accuracy.

Topic III-2. Animals

The animal kingdom will be discussed, and the various phyla briefly mentioned. The relationships of one group of animals to another will be discussed. The human will be used as an example of animal structure.

Goal 1: The student will understand the characteristics and relationships of various groups of animals.

Obj. 1: Given 15 multiple choice questions on the animal kingdom (covering characteristics of animal groups) the student will answer 10 correctly.

Obj. 2: The student will draw a phylogenetic tree including the major phyla showing correct evolutionary relationships (70%).

Goal 2: The student will understand the structure of a higher animal.

Obj. 1: Given 10 multiple choice questions on the structural and functional anatomy of a mammal (human) the student will answer 7 correctly.

Topic III-3. Population Dynamics

The relationships of plants and animals to one another and to the environemnt will be considered.

Goal 1: The student will understand the principles of the community and its relationship to the environment.

Obj. 1: Given 10 multiple choice questions on the diversity of animal and plant life (considering terrain, horizontal and vertical clines in ecology, and types of communities) the student will answer 7 correctly.

Obj. 2: Given 3 multiple choice questions on the cyclic reatlionships between plants and animals the student will answer 2 correctly.

Goal 2: The student will understand the mode of distribution of plants and animals over the world and the subdivisions of the world by plant and animal material.

Obj. 1: Given 5 multiple choice questions on the biogeographical regions, and methods of dispersal of plants and animals the student will answer 3 correctly.

BIOLOGY OBJECTIVES: SET # 2

Goals for Principles of Biology

End of Course Goals

(1) The student will know and understand the basic concepts and principles of biology - life as we know it on earth.

(2) Students will be familiar with and understand the basic terminology in the field of biology as-well-as the principles and concepts.

(3) Students will know the basic terminology and will understand the basic principles and concepts in the biological sciences.

Unit Goals

Unit I - The Living Cell
The students will know the parts found in most living cells. The students will understand the basic functions and activities that occur within living cells.

Unit II - Molecular and Chemical Aspects
The student will know the basic molecular and chemical aspects of life as they are related to the functions and activities of the living cell.

Unit III - Plant Kingdom
The student will understand how plants are classified and will know an example for each large grouping.

Unit IV - Animal Kingdom
The student will understand how animals are classified and will know an example for each large grouping.

Unit V - Parasitology
The student will understand the basic concepts of parasitology and how these concepts fit into the life cycles of a few examples. He will know the life cycles of the examples.

Unit VI - Ecology
The student will know and understand the major relationships of living organisms to their environment with the biological principles and concepts involved. He/She will understand how the form of living organisms is associated with these relationships.

Unit VII - Natural Selection
The student will know and understand the concept of Natural Selection, how it operates with examples, and the relation between Natural Selection and Darwin's Theory of Evolution.

Unit VIII - Evolution
The student will know and understand the Theory of Evolution, how it applies to all living organisms, and some outstanding examples.

Unit IX - Respiration
The student will know and understand the principles of respiration in both the Plant and Animal Kingdoms, and the process of photosynthesis and its relation to respiration.

Unit X - Nutrition
The student will know and understand the principles and concepts of nutrition in both the Plant and Animal Kingdoms, with the process of digestion.

THE INDEPENDENT STUDY SESSION

ISS Unit I - The Tools of Biology

Objectives

1. Given a diagram of a microscope the student will identify all parts indicated. Exam conditions.

2. Given a prepared microscope slide, the student will demonstrate to the satisfaction of the laboratory instructor his competence in the use of the microscope, using both the low and the high power objectives. Time allowed: 5 minutes.

3. Given statements associated with the terms used in microscopy the student will select the correct term from a list of alternatives. Exam conditions.

4. Given statements associated with the terms used in the Metric System the student will select the correct term from a list of alternatives. Exam conditions.

ISS Unit II - The Living Cell

Objectives

1. Given a diagram of a plant or animal cell, the student will identify each of twenty parts as indicated. Exam conditions.

2. Given a list of five functions the student will select from a given list of cell parts the one to which each of the functions have been ascribed. Exam conditions.

3. Given a list of ten activities within a cell, the student will select from a given list of cell parts and areas the one to which each of the activities have been ascribed. Exam conditions.

4. Given the description of a phase in mitosis, the student will select that phase from a list of alternatives. Exam conditions.

5. Outside of class the student will write a paper describing what occurs during the process of mitosis. He will name and define each phase of mitosis and explain the continuning process in 1,000 to 1,500 words in informal style showing only the title at the top of the first page and indicate the source of the information on the last page.

6. The student will define the Cell Principle. Exam conditions.

ISS Unit III - Molecular and Chemical Aspects

1. Given five functions of chemicals in the cell, the student will be able to pick out of a list of chemicals the major one involved in each of the functions. Exam conditions.

2. Given the functions of one of the three groups of organic food compounds, the student will select the correct compound from a list of alternatives. Exam conditions.

3. Given a list of ten chemical compounds, the student will give the cell part where each is found in the largest quanities. One cell part for each compound. Exam conditions.

4. Given five chemical formula of activities within the living cell, the student will select the correct defination and explaination for each of them from a given list of alternatives. Exam conditions.

5. Given a defination and explaination of a chemical activity within the cell, the student will select the correct chemical formula illustrating this activity from a given list of alternatives. Exam conditions.

6. Given a sugar solution in a semi-permeable membrane, set in a beaker of sugar solution of the same concentration, the student will select from several alternatives what would happen if water were added to the beaker. Exam conditions.

7. Given a chemical activity within a cell, the student will select from several alternatives, the major element envolved. Exam conditions.

ISS Unit IV - Plant Life

1. Given ten plants, the student will note which of the large plant groupings in which each of the plants have been placed. Exam conditions.

2. Outside of class the student will write a paper of 1,500 to 2,000 words on the most accepted method of plant classification. How are plants classified? What are the major criteria of plant classification? The paper shall be in formal style with:
1. Title page
2. Table of Contents
3. Text
4. Bibliography
5. Footnotes

This paper will require a minimum of five references in the bibliography.

3. Given three sets of plant characteristics, the student will indicate to which large plant classification grouping each set belongs from a given list of groupings. Exam conditions.

ISS Unit V - Animal Life

1. Given twenty animals, the student will note which of the large animal groupings in which each of the animals have been placed. Exam conditions.

2. Outside of class the student will completely classify five animals assigned from a list of twenty animals. The student will note the group and the sub-groups inwhich each of his animals have been placed and will tell WHY - with animal characteristics - ten to 30 words for each explaination. The student will note the source of his classifications.

3. Given ten sets of animal characteristics the student will indicate to which large animal classification grouping each set belongs from a given list of groups. Exam conditions.

4. Given a list of 10 animals the student will select the characteristic which applies to each of the animals. One characteristic is to be assigned for each animal, from a list of alternatives. Exam conditions.

5. Given a group of 20 animals, the student will arrange the animals in groups according to the "Levels of Organization" given. Exam conditions.

6. Given an animal, the student will classify the animal and will tell why he has placed the animal in each of the groups or sub-groups. The student will be given fifteen minutes and the use of one book on classification.

7. Given a group of twenty animals the student will arrange them in groups according to their characteristics as required for Phyla and Classes of the Animal Kingdom. He will do this without help and within twenty minutes.

ISS Unit VI - Parasitology

1. Given three life cycle diagrams for parasites, the student will identify each parasite and identify the parts of the life cycle. Exam conditions.

2. Given a list of five relationships of parasites to the host organism, the student will select from a list of parasites a parasite that exhibits each relationship. Exam conditions.

3. Outside of class the student will write a paper of 500 to 1,000 words illustrating a given concept of parasitology with a life cycle of an example. Included in the paper will be the relationship between the host organism and the parasite. List the advantages the parasite has. This paper need not be in formal style, but should include a bibliography.

ISS Unit VII - Ecology

1. Given a list of animal associations to the environment, the student will select the form the animal is most likely to have from a list of alternatives. Exam conditions.

2. Given a statement of the structural adaptation of a Tracheophyte, the student will select the correct Hydrophytic adaptation from a list of alternatives. Exam conditions.

3. Given a xerophytic adaptation of Tracheophytes, the student will select the statement of structural adaptation to which it applies from a list of alternatives. Exam conditions.

4. Given a vertebrate skeletal adaptation, the student will select the environmental conditions where the vertebrate would be expected to live from a list of alternatives. Exam conditions.

ISS Unit VIII - Natural Selection and Evolution

1. Given a description of a type of evolution, the student will select that type from a list of alternatives. Exam conditions.

2. Given a set of conditions, the student will select the type of evolution expected to occur from a list of alternatives. Exam conditions.

3. Outside of class the student will write a 2,000 to 3,000 word paper on the Theory of Evolution as based upon Darwin's work. He will define the Theory. A formal paper with:
1. Title page
2. Outline
3. Table of Contents
4. Text
5. Footnotes
6. Bibliography

This paper will have a mimimum of five references in the bibliography.

4. Given the description of a "level of Organization" of an animal, the student will select the proper statement giving the animal's form and structure upon which the "level of organization" is based from a list of alternatives. Exam conditions.

ISS Unit IX - Respiration

1. Given a description of a type of respiration, the student will select the type from a list of alternatives. Exam conditions.

2. Given the respiratory rate for a certain animal under given conditions the student will select the temperature under which this rate is most likely to occur from a list of alternatives. Exam conditions.

3. From a list of plant parts, the student will select the part where photosynthesis occurs at the greatest rate. Examination conditions.

4. From a list of given chemical compounds the student will select the one that is found in each step in the process of respiration as studied. Exam conditions.

5. From a list of given chemical compounds the student will select the one that is found in each step in the process of photosynthesis as studied. Exam conditions.

ISS Unit X - Nutrition

1. Given "The Adventures of a Ham Sandwich" the student will select the proper term for each blank from a list of alternatives. Exam conditions.

2. Given a set of symptoms for a specific example plant, the student will select the mineral of which the plant is apparently deficient from a list of alternatives. Exam conditions.

3. Given a function for a vitamin in the human body, the student will select the vitamin from a given list of alternatives. Exam conditions.

4. Given an enzyme of digestion the student will select the region of the digestive system where the action of the enzyme takes place from a list of alternatives. Exam conditions.

5. Given an action of an enzyme upon a given food compound, the student will select that enzyme from a list of alternatives. Exam conditions.

BIOLOGY OBJECTIVES: SET # 3

Unit I - Introduction to Biology and the Cell

- General objectives:
  The student will identify the major historical devdlopments in biology.
  Specific:
  Given a list of names the student will relate the correct person to the corresponding historical period.
  Given a list of biological disciplines the student will rearrange them in order of their historical development or respective age.
- General:
  The student will utilize the scientific method to approach and solve a problem
  Specific:
  The student will define the various parts of the scientific method.
  The student will define the term "controlled experiment" or describe a "controlled experiment."
  Given the formation of the coral Atolls as a problem the student will apply the appropriate part of the scientific method to the corresponding part of the problem.
  With the use of diagrams the student will describe three different hypotheses which account for the formation of the coral atolls.
  The student will provide a list of facts to account for one of the hypotheses.
  In a brief paragraph the student will compare an assumption and a fact and define the meaning of both terms.

— General:
The student will list the major generalizations of the biological sciences and the principles upon which they have been proposed.
Specific:
The student will define the theory of biogenesis
The student will list the assumptions upon which this theory is based.
The student will list the facts upon which this theory is based.
The student will select from a list of names those people who conducted experiments which supported:
the theory of biogenesis.
the cell theory.
the gene theory.
the theory of organic evolution.
theory of enzymes and metabolism.
the theory of genic control of metabolism.
the theory of vitamins and coenzymes.
the theory of hormones.
the theory concerning the interractions of organisms and their environment.
In two or three sentences the student will write the cell theory and the theory of organic evolution as it was developed by Charles Darwin.
The student will use two or three sentences to describe Lamark's theory of evolution.

- General:
The student will describe the properties of the typical cell.
Specific:
The student will list (in outline form) the universal properties of protoplasm.
Given a list of various forms of matter the student will provide a one or two sentence devinition for each form.

The student will diagram a typical atom and label its parts.

In a brief paragraph the student will explain the importance and location of _____ in the typical cell.

carbohydrates
lipids
proteins
nucleic acids

The student will list two examples for each of the above compounds.

From a list of structural formulas the student will label those which represent:

carbohydrates
fats
proteins
amino acids
nucleic acids
nucleotide
purine
pyrimidine

The student will list the four types of bases found in DNA and RNA.

The student will diagram and label a "typical cell."

Given a list of possibilities the student will match cellular functions to the corresponding parts of the cell.

In outline form and with the use of diagrams the student will describe an experiment which proves that the nucleus controls the cell. It is expected that the student will use information gained from experiments conducted with Acetabularia.

The student will define tha various types of energy utilized by the cell, and their respective roles in the cell.

The student shall define the following given terms:
osmosis
diffusion
turgor pressure
With the use of diagrammatic models the student shall explain how water is transported in and out of the cell.
In one or two sentences the student shall define the term tissue.

— General:
The student shall describe different levels of organization in the living organism.
Specific:
The student shall give examples of five different types of ~~plant or~~ animal tissue.
The student shall diagram a cell which is typical of each of these types of tissue.
The student shall use a single sentence to describe the principle function of each of these five tissues.
The student shall list the four types of plant tissue.
The student shall match each type of plant tissue with a diagram of a typical cell taken from that type of tissue.
The student shall diagram the location of each of these four tissues in the mature plant.
From a list of choices the student shall identify five types of organ systems.
Given three of these organ systems the student shall list its principle function in a brief sentence.
Given a series of diagrams of basic body plans the student shall identify given types of symmetry and shall show the different planes of division by drawing a single line with his pencil.

—General:

The student shall describe or define the components of the different systems of cellular metabolism.

The student shall match the following terms with their correct definitions or descriptions.

respiration
fermentation
balanced equation
element
compound
enzyme
catalyst
peroxidase
lipase
adenosine triphosphate (ATP)
coenzyme
ribonuclease
pepsin
electron transmitter system
oxidation
reduction
decarboxylation
electron acceptor
diphosphopyridine nucleotide (DPN)
electron acceptor
Citric Acid Cycle
Glycolysis
deamination

Given a number of choices the student shall identify the properties of enzymes.

With a series of labeled diagrams the student will use the template theory to explain the action of enzymes.

The student shall list in outline form those factors which affect the activity of enzymes.

General:

The student shall describe the major parts of the processes of fermentation and respiration.

Specific:

The student will make a diagram showing the basic reactions of the electron transport system.

Showing the number of carbon atoms in each Compound the student shall make a diagrammatic representation of fermentation.

The student shall identify from a list of choices the number of ATP and ADP produced and utilized in fermentation.

Showing the number of carbon atoms in each compound the student shall make a diagrammatic representation of aerobic respiration.

Given a number of possibilities the student shall identify the number of ATP and ADP produced and utilized in respiration..

Given a number of possibilities the student shall identify the number of ATP produced in the citric acid cycle .

In a brief paragraph the student shall describe the difference between DPN and TPN.

Using carbon skeletons the student shall diagram the process of respiration.

Unit II - The Plant Kingdom

General:
The student shall list the various factors associated with the process of photosynthesis.
Specific:
Given a choice of various types of energy the student shall choose the energy source for photosynthesis.
The student shall diagram a chloroplast and list its parts.
The student shall indicate where the light reactions and the dark reactions occur in the chloroplast.
The student shall write the balanced formula for photosynthesis using the accepted method of "chemical shorthand."

General:
The student shall indicate the role of plant pigments in the process of photosynthesis.
Specific:
The student shall list five different kinds of plant pigments.
Given the axis and coordinates of a graph the student shall draw the curve for the action spectrum of photosynthesis.

General:
The student shall present an experiment which was used to determine the path of carbon in photosynthesis.
Specific:
From a list of names the student shall select the name of the man who determined the path of carbon in photosynthesis.
Given the structural formulas of the compounds involved in photosynthesis the student shall name the compounds and describe their respective roles with a brief sentence.
The student shall diagram an experiment which proves that oxygen is produced during photosynthesis and label the appropriate parts of the diagram.

General:
The student shall define the properties of plant cells.
Specific:
The student shall diagram the plant cell before and after it has plasmolysed.
The student shall define the term cyclosis.
The student shall choole from a list of cell organelles those organelles which are characteristic of plant cells but not of animal cells.
General:
The student shall list the means by which the plant coordinates its activities.
Specific:
The student shall define the role of the xylem and phloem.
The student shall define the following terms in a single sentence.

tropism
taxis
phototropism
geotropism

The student shall discuss in a brief paragraph the interaction of auxins, light and plant growth.
Given a series of descriptions the student shall select those which describe Fritz Wents classical bioassay experiment.
The student shall define the term bioassay.
In a brief paragraph the student shall differentiate between a long day plant and a short day plant.
General:
The student shall discuss the structure and functions of the major parts of a typical higher plant.
The student shall list the functions of the root.
The student shall diagram a typical cell from each zone of the root tip.

Given a diagram of the crossection of a stem
the student shall label its parts
The student shall list the functions of the leaf.
The student shall diagram a group of cells from
the following layers of the leaf:

Palisade layer
Spongy mesophyll layer
lower epidermis
upper epidermis

The student shall list the major functions of the stomates.
In outline form the student shall trace the path of a water molecule through the plant from a root hair and out the leaf.
General:
The student shall list and describe some basic properties of microorganisms.
Specific:
The student shall list Koch's postulates
The student shall diagram and describe 3 different types of bacteria.
The student shall define the following types of bacteria in one or two sentences.

aerobes
anaerobes
obligate anaerobes
facultative anaerobes

The student shall describe each of the following three organisms in a brief paragraph:

viruses
bacteriophages
rickettsias

The student shall diagram the life cycle of a typical bacteriophage.

With an outline of major points the student will support one of the following statements.

The virus is an advanced form of life.

The virus is a primitive form of life.

General:

The student shall describe the structural and reproductive differences between the major plant groups.

The student shall define alternation of generations.

In outline form the student will compare the characteristics of the blue-green algae with those of the green algae.

In a series of short sentences the student shall differentiate between the following groups.

Given a list of the characteristics of algae and fungi the student shall match the caracteristic with the appropriate organism.

The student shall compare a slime mold with a amoeba in a short paragraph or brief outline.

In three or less sentendes the student shall define the term thallophyte.

The student shall describe the structure, reproduction, and nutrition of a lichen in a brief paragraph.

Given a diagram of the life cycle of a moss and of a liverwort the student shall label the following parts:

protonema
rhizoid
gametophyte
sporophyte
antheridia
archegonia
sperm
egg

Given a list of descriptions the student shall differentiate between those which are characteristics of monocots and those which are characteristics of dicots.

Given three diagrams of different life cycles the student will determine the following information:

- Which type is most primitive
- Where meiosis occurs in each type
- which types show an alternation of generations
- Which type is most similar to the flowering plants.

The student will identify the following parts when given a life cycle of a typical angiosperm

- male gametophyte
- female gametophyte
- sporophyte
- embryo
- egg sack
- egg
- cotyledon
- epicotyl
- hypocotyl

The student will draw a diagram of the flower and label its parts.

Unit III - The Animal Kingdom

—General:
The student shall analyze the various levels of organization found in the invertebrates.

Specific:
The student shall list the characteristics used to classify animals
The student shall diagram and label the organism Euglena.
The student shall list the characteristics of the phylum porifera.
From a list of characteristics the student shall check those which are found in Hydra with an H and those which are found in Planaria with a P.
The student shall name and describe with a diagram the organism which has the simplest or most primitive organ level of organization.
In a brief paragraph the student shall distinguish between homologous and analogous organs.

— General:
The student shall characterize the various parts of the higher invertebrates.

Specific:
Given a list of characteristics the student shall list: those which can be attributed to a tapeworm, those which can be attributed to a roundworm, and those which can be attributed to an earthworm.
In outline form the student shall compare the means used by higher plants and animals to bring about the union of an egg and sperm in the absence of a watery medium.
The student shall list the basic features of the molluscan body plan.
Given a list of choices the student shall list those characteristics of arthropods which are of evolutionary significance.
The student shall outline two basic types of metamorphosis and list a class of animals which which exhibits both types.

—General:

The student shall show the major evolutionary and structural relationships within the vertebrates.

Specific:

The studens shall list the major characteristics of the phylum Chordata.

In a brief paragraph the student shall describe the function of gills in fish.

The student shall identify from a list of choices those groups which share the following structures:

air sacs

swim bladders

placenta

In outline form the student shall compare the major characteristics of birds and mammals.

The student shall list the various regions of the frogs brain and in a brief sentence bive their major function.

The student shall list the complete classification of man.

The student shall make a generalized diagram of a vertebrate showing and labeling the major parts.

—General:

The student shall describe the barious levels of organization in higher animals.

Specific:

The student shall list the seven functions of blood in man

Given a list of characteristics the student shall identify those which match plasma, serum, lymph and tissue fluid.

In a brief paragraph the student shall describe the origin, occurance and death of red blood cells.

The student shall list the main structural and functional differences between white blood cells and red blood cells.
In a brief paragraph the student shall describe the clotting mechanism.
Given a list of the major components of blood plasma the student shall match them with their major functions.
The student shall diagram the mammalian heart and trace the flow of blood through it.

Unit IV - Genetics and Evolution

General:

The student shall derive the theory of evolution.
and apply it to evolutionary problems.

Specific:

The student shall list the basic assumptions
of darwins theory of evolution.

The student shall list the basic assumptions of
Lamarcks theory of evolution.

The student shall present a mechanism for the
process of adaptation based on Darwins theory of evolution.

The student shall present a mechanism for the process
of adaptation based on Lamarcks theory of evolution.

In a brief paragraph the student shall use Darwin's
theory of evolution to solve a sample problem.

The student shall define the following terms.

Adaptation
Natural Selection
Evolution
Organism
Survival of the Fittest

In a brief paragraph the student shall describe what
the ideas of Malthus contributed to Darwin's theory
of evolution.

Unit IV - Genetics and evolution

General Objectives:

Given the conditions of the primitive atmosphere of the earth the student will describe a series of assumptions and theories which explain the manner in which the basic components of life evolved.

Specific Objectives:

The student will list the structural formulas of the primary constituents of the primitive atmosphere.

The student will list the major assumptions of Daltons Atomic Theory.

The student will analyze a typical atom and describe the properties of its sub atomic particles.

The student will list the various forms of energy which affect the typical atom and describe the respective effects.

Using knowledge derived from the atomic theory and the properties of simple gases the student will describe how simple organic molecules can be formed.

Using knowledge of the properties of proteins the student will be able to list the steps by which proteins gathered to form coacervates.

The student will define the terms activation energy, diffusion, and osmosis.

The student will describe Miller's experiment on the production of amino acids.

The student will compare the experiments of Fox and Miller.

General Objectives:
The student will describe the various steps by which the coacervate uses chemical bond energy to maintain its organization.

Specific Objectives:
The student will define the energy needs of the primitive coacervate.
The student will define the terms catalyst and enzyme in terms of their respective properties.
The student will provide a diagrammatic and written representation of enzyme action.
The student will identify the molecular structure of a typical sugar.
The student will identify the total number of ATP produced and utilized in fermentation.
The student will identify the components of the ATP molecule (from a list of chemical structures).
The student will define the terms active transport and diffusion.

General Objectives:

The student will list a series of assumptions which describe a means by which stabilizatin and control of the Life Processes is established.

Specific Objectives:

The student will list the properties of the nucleic acid molecule which enabled it to establish this primary control over the basic cell processes.

The student will be able to identify the units of the nucleic acid molecule from a list of different organic molecules.

The student will describe two experiments which indicate that mucleic acids established control over the basic cell processes.

The student must provide evidence for the necessity of duplicating the hereditary material.

The student will identify the properties of DNA which enable it to provide for accurate duplication.

The student will describe how the detailed structure of DNA (model) was interpreted.

The student will describe the helical structure of DNA with a written diagrammatic model.

The student will use theterms M-RNA, transfer RNA, ribosomes, and amino acid to describe a mechanism by which DNA can code for protein structure.

The student will define the DNA molecule in terms of structure and arrangement of substances.

The student will identify an experiment which indicates that DNA is the genetic material.

The student will identify from a list of possibilities the type of bonds which hold the DNA molecule together.

General Objectives:

The student will describe how the DNA molecule codes for the specific sequence of amino acids in proteins.

Specific Objectives:

The student will determine from a list of possibilities the specific characteristics which the code must have in order to code for amino acid sequence in proteins.

The student will identify the chemical groups which compose the DNA code symbols.

The student will provide evidence which indicates that the DNA code word must be composed of three letters.

The student will identify means by which the DNA code is translated to M-RNA.

The student will list the steps in protein synthesis.

The student will identify the site of protein synthesis in the cell.

The student will describe how a change or mutation in the DNA code can be produced.

General Objectives:
The student shall cite the evidence for the laws of heredity.
The student shall solve a series of genetic problems and apply appropriate terminology to various parts of the problem.
The student shall list the contributions which Gregor Mendel made to the science of genetics.
Specific Objectives:
The student shall be asked to solve a problem involving a monohybrid cross.
The student shall be asked to solve a problem involving a dihybrid cross, and sex linkage.
In the above problems the student shall identify the genotype and phenotype of the parents and the offspring.
The student shall diagram and label the process of meiosis, and compare it to the process of mitosis.
The student shall define the terms: (in 2 sentences or less)

gene
genotype
phenotype
evolution

BIOLOGY OBJECTIVES: SET # 4

GOALS AND STUDY OBJECTIVES FOR BIOLOGY 1

Terms used in this outline:

Goal: The general outcome toward which the student is directed--the concept or understanding.

Objective: The specific skill, ability, or attitude which the student is expected to attain.

Criterion: The level of achievement the student must reach in order to pass with a "C" for each objective, expressed as a percent.

Objectives

1. Goal: The student will understand that life is a series of processes that can be studied scientifically.

Objective 1. From a list of 20 vocabulary words drawn from Chapters 1 & 2 in Kimball, and from lecture, he will match each with its correct definition. 8 out of 10 correct.

Vocabulary:

responsiveness	growth
stimulus	ecology
hormone	biotic factor
nerve	abiotic factor
behavior	parasitism
cell	evolution
tissue	adaptation
organ	form or structure
metabolism	species
asexual reproduction	breed or variety

Test sample: Which of the following constitutes the best definition of a stimulus?

1. behavior
2. a brain
3. eyes
4. a change
5. leg muscles

Objective 2. From a list of five basic biological processes, the student will be able to match the process with a biological activity. 70%

Test samples: For each item below, note the number of the biological process it represents from the given list.

List:
1. Reproduction
2. Metabolism
3. Adaptation
4. Growth & Development
5. Inheritance

1. _____A Pierce College student digests a hamburger.
2. _____A spider spins a web in the library.
3. _____A cottontail rabbit pulls hair to line her nest.
4. _____A single cell divides into two daughter cells.
5. _____A lizard regenerates a lost tail.
6. _____The infant weights 30 lbs at age 6 months.

Objective 3. Given a list of statements descriptive of nine characteristics and processes of life, he will note the characteristic feature or process to which each applies. 70%

2. Goal: The student will understand the principles of classification.

Objective 1. The student will apply the concept of Homology to pairs of items and distinguish between those that are Homologous and those that are analogous.

Test samples: An example of homologous structures are:
1. The swimbladder in fish and the lungs of man.
2. The wing of a bat and the wing of a bird.
3. The wing of a bat and the wing of a butterfly.
4. 1 and 2.
5. 2 and 3.

Objective 2. From a list of 10 kinds of organisms, he will note the symmetry that is shown by each. 7 out of 10

Test example: Mark 1) if radial or biradial
Mark 2) if assymetrical
Mark 3) if spherical
Mark 4) if bilateral

1. _____jellyfish
2. _____shark
3. _____hydra
4. _____sponge
5. _____comb jelly or ctenophore
6. _____medusa
7. _____amoeba (lab)
8. _____paramecium
9. _____Simon & Garfunkle
10. _____gopher snake

Objective 3. Given an example of taxonomic nomenclature, as Lynx rufus californicus (see text p. 19), the student will be able to note and select from a list, the information stored in each term. 70%

Objective 4. On a test, the student will be able to set up a classification system that includes a dog, wolf, kit fox, horse, zebra, lizard, bird, and crocodile (or any other similar diverse assemblage of creatures) 70%

3. Goal: The student will understand the concept of the population sample as the species; and that the species is the smallest taxonomic unit.

Objective 1. From a list of statements, the student will indicate those useful in characterizing a species. 65%

Test sample: For each of the following statements

Mark 1) if the statement does apply
Mark 2) if the statement does not apply

to the modern species concept.

1. _____Have fertile offspring
2. _____are morphologically distinct, but have fertile offspring
3. _____look alike and occupy the same territory
4. _____is a kangaroo rat in the Pierce College Biology lab.
5. _____is a population of kangaroo rates in the Mojave desert.
6. _____is a fixed concept, unchanging.

4. Goal: The student will understand that the Monera & Protista comprise a diverse group of organisms that have had a long, independent evolutionary history.

Objective 1. From a list of vocabulary words drawn from Chapt. 3, lab, and from lecture, he will be able to match each with its correct definition.

Vocabulary

Protozoa	spore
pseudopodia	bacilli, cocci, spirilla
flagella	plastid
cilia	nucleoprotein
aerobe	hyphae
anerobe	mycelium
saprophyte	holdfast
obligate parasite	lichen
host	

Objective 2. Given a list of Monera and Protista, the student will be able to match each with its major characteristic.

Test example: For the following statements, indicate whether each is:

1. True only of slime molds
2. True only of fungi
3. True only of virus
4. True only of algae
5. True only of bluegreen algae

1. _____are obligate parasites that can be crystalized
2. _____at one stage in their life they are a moving, creeping mass.
3. _____Possess chlorophyll organized in plastids; body a thallus.
4. _____Have no chlorophyll; no true roots, stems, leaves.

5. Goal: The student will understand the main stages of evolution in plants and the structural and functional developments that make them individually, the most widespread and numerous of all living things.

Objective 1. From a list of vocabulary words drawn from Chapter 4, lab, and lectur lecture, the student will match each with its correct definition. 80%

Vocabulary:

rhizoid	cone	monocot
tracheophyta	flower	dicot
vascular tissue	rizome	
embryo	root	
seed	chloroplast	

Objective 2. On a test, given a list of the major plant phyla and a series of statements describing their major characteristics, habitats, manner of growth or of reproduction, the student can match each phylum with the correct statement. 70%

Objective 3. On a test, given an assortment of 5 plants, he can order them in an evolutionary sequence. 70% if the simplest and most advanced plants are correctly placed; 10% each for correct sequence of the intermediate phyla.

Test sample: Indicate the order (from simple to advanced) into which the plants in the following list would best be placed.

If the order should be:

ABC, Mark 1
ACB, Mark 2
BAC, Mark 3
BCA, Mark 4
CAB, Mark 5

List: A. Bracken fern
B. Yellow pine
C. Marchantia

6. Goal: The student will understand that the diversity of forms of animals is essentially one of diversity of ways of making a living.

Objective 1. From a list of words drawn from Chapter 5, from lab, and from lecture, the student will match each with its correct definition. 80%

Vocabulary:

mesoglea	larvae	tube foot
cnidoblasts & nematocysts	proglottids	water vascular system
tentacles	pseudocoel	notochord
gastrovascular cavity	coelom	dorsal nerve cord
cephalization	chemocoel	gill slits
ectoderm	bristle appendages	
endoderm	radula	mammary glands & hair
mesoderm	chitin	
viviparous	homeotherms	head, thorax,
placenta	poikilotherms	abdomen

Objective 2. On a test, given a list of animal phyla and a series of statements or descriptions, the student can match each animal with its correct phyla with 70% accuracy.

Test sample:
Match the statement with the item.

Items:
1. Echinodermata
2. Porifera
3. Annelida
4. Coelenterata
5. none of these

1._____Beating collar cells move a stream of water through the colony.
2._____Has tube feet and a water vascular system.
3._____Sweeps food into its mouth with its radula.
4._____Poisons its prey with its nematocysts.
5._____Has a bristle appendage on each segment.

Objective 3. The student will indicate the relationship between a series of statements concerning special pre-adaptive characteristics and the morphological and physiological problems involved in a big shift in habitat, as from water to land. 60%

Test sample:
Analyze each of the statements below and indicate that characteristic which would probably be most effective for maximum selective advantage to the 1st 4-legged creatures making a transition from water to land.

Characteristics:
1. supportive skeleton & locomotion.
2. protection against the environment.
3. excretory system
4. respiratory system
5. sense organs

1_____Water is 800 times as heavy as air
2_____Ammonia is injurious to cells even in low concentration
3_____Oxygen must be taken up from the air
4_____ciliary motion is useless in air
5_____stimuli must be received long range & from great distances
6_____There is a selective premium on scales and armor

7. Goal. The laws governing the chemical and physical events in living matter are the same as those acting on non-living matter.

Objective 1. The student will learn the vocabulary selected from Chapters 6 & 7 so that on a test, he can match the word with the correct definition or example with 80% accuracy.

Vocabulary:
morphology
physiology

atom
molecule
element
trace element

proton
electron
neutron

electro-negative
electro-positive
isotope

chemical compound

ion
ionic bond
dissociation

valence

covalent bond-single, double
molecular formula
structural formula

ion-exchange reactions
oxidation-reduction reaction
catalyst
enzyme

mixture
solution
suspension
colloid
macromolecule

Objective 2. Given a list of items, the student will be able to note which atoms, molecules; elements, compounds, mixtures; and which of the mixtures may be considered to be solutions, suspensions, or colloidal dispersions. 70%

Test sample: For the following items note whether they are best considered
1. element
2. molecule
3. solution
4. suspension
5. colloid

1._____clay
2._____fog
3._____CO_2
4._____glucose
5._____egg white

8. Goal: The student will understand that living things are characterized by 4 types of complex molecules.

Objective 1. Given a list of statements, the student will indicate which is most true of the following substances. 60%

Test sample: Mark 1, if the statement is mostly true of carbohydrates.
Mark 2, if true of lipids
Mark 3, if true of proteins
Mark 4, if true of nucleic acids and nucleotides
Mark 5, if true of carrier molecules (see lecture notes)

1._____tend to gain or lose electrons to other molecules in a very short time
2._____break down to yield glyerol and fatty acids
3._____certain of these are enzyme catalysts
4._____are macromolecules composed of repeating units of amino acids

Objective 2. Given a list of the smallest molecules found in living systems, he will match the molecule with its function. 70%

9. Goal: The student will understand that the cell is the smallest organization of matter that is alive.

Objective 1. Given a list of structures inside the living cell, the student will designate whether or not they are found in the cytoplasm or in the nucleus. 70%

Objective 2. The student will be able to match structure with function of the organelles listed below.
1) chloroplast
2) nucleus
3) chromosome
4) cytoplasm
5) cell membrane
6) mitochondria
7) ribosomes
8) centriole
9) endoplasmic reticulum (ER)
10) lysosome
11) vacuole

Objective 3. On a test, he will be able to match each of 7 plant tissues and each of 5 animal tissues with its correct structure and function. 70%

10. Goal: The student will understand that the method of transport of molecules in living matter depends upon their size.

Objective 1. From a list of words drawn from Chapter 9, and from lecture, the student will match each with its correct definition on a test. 8 out of 10

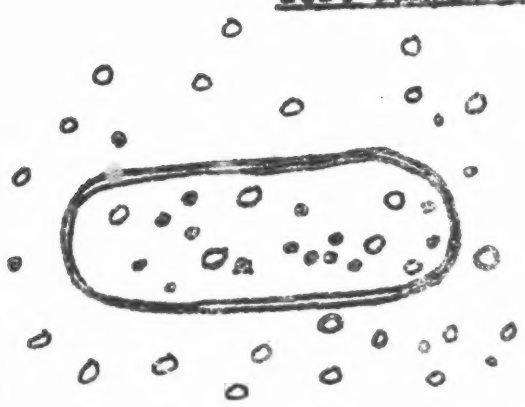
Vocabulary:

Diffusion
Brownian movement
Imbibition
Turgor
Differentially or semi-permeable
osmosis
concentration gradient
solute
solvent
active transport
passive transport
isotonic
hypotonic
hypertonic
plasmolysis
phagocytosis
pinocytosis
salt glands....birds, reptiles, fish

Objective 2. He will be able to apply the principle of osmosis to several different biological situations presented to him in the laboratory and be able to predict the effect of the movement of water through plant cell membranes. 70%

Objective 3. He will be able to relate his laboratory observations of osmosis and diffusion in Elodea to diagramatic representation of the same processes on a lecture test examination. 70%

Test sample: In the diagram, the black dots represent dissolved particles; the hollow spheres are water molecules. As a result of the difference in concentration,



Mark 1, if the system is stable
Mark 2, if the dissolved particles will move across the cell membrane
Mark 3, if the water molecules will move across the cell membrane
Mark 4, if there is not enough evidence given to tell

Objective 4. The student will be able to distinguish between osmosis, simple diffusion, active transport, phagocytosis, and pinocytosis and be able to match each process with a characteristic statement descriptive of the process or its function. 60%

Objective 5. Given an example of an organism, as a fish, in either a salt water or Fresh Water-Brackish environment, the student will select appropriate osmotic regulating adaptations for each environment from a list of statements. 60%

Test sample:

For each of the following statements indicate whether it

1) does
2) does not

function in osmotic regulation for a fish in a marine environment.

1_____Has a contractile vacuole to pump water out of the body.
2_____Produces concentrated, scant urine
3_____Produces copious, dilute urine
4_____Has a salt gland that brings salt into the body from the environment

11. Goal: The student will understand that the energy obtained by photosynthesis is transferred to high-energy phosphate bonds in ATP before being used for cellular activity.

Objective 1. The student will be able to diagram the ADP—ATP cycle and from a given list of biological activities will be able to predict whether [illegible] ATP will be formed or whether or not, less ATP will result. 60%
Test sample: From the list of statements below, indicate whether the net result of the biological activity will result in more or less, ATP.

1) More
2) Less

1_____A glucose molecule is broken down in the cytoplasm of the cell.
2_____A water molecule is split by solar energy trapped by chlorophyll.
3_____ADP gains a high energy phosphate
4_____Two amino acids are linked to form a protein chain.

12. Goal: Photosynthesis is the method by which light energy is transformed into a more useable form of energy in chemical bonds. The student will understand that it is essentially the reduction of CO_2 with hydrogen obtained by splitting water molecules.

Objective 1. From a list of words drawn from Chapter 12, and from lab, and from lecture, the student will match each with its correct definition on a test. 80%

Vocabulary:
autotroph
heterotroph
pigments: Chlorophyll a
" b
Carotenoids
Chloroplast:
lamellae
grana
Leaf: Upper epidermis
palisade layer
spongy mesophyll
stomata
guard cells

Light Reactions:
photolysis
cyclic photophosphorylation
cytochrome enzyme system

Dark Reactions:
NAD
$NADH_2$
di-
ribulose/phosphate
PGA
PGAL
carbon fixation

Objective 2. Given a list of the steps in Photosynthesis, the student will order them in sequence. 60 % credit for the correct placement of materials into and materials out of the process. 10% for correct sequential placement of each intermediate step. 60%

Objective 3. He will indicate which of the following items in photosynthesis occurs during the light reaction series; and which during the dark reaction series; and which are materials into and which materials out of the cycle. 60%
Test sample: From the list of items below, choose the one that best characterizes the following statements:

1) (is) are part of the light reaction series
2) (is) are part of the dark reaction series
3) (is) are materials entering the photosynthesis cycle
4) (is) are materials produced by the photosynthesis cycle
5) (is) are either intermediate or carrier compounds

1_____CO_2 & H_2O
2_____PGAL & O_2
3_____Hydrogen ion and O_2
4_____ATP is formed from ADP & $\sim P$
5_____PGAL

13. Goal: The student will understand that transport systems are necessary when some of the organism's cells are too distant from the environment to obtain materials by diffusion.

Objective 1. Given 10 multiple choice items concerning definitions of vocabulary words drawn from pages 205-209; and from Chapter 15.; the student will answer seven correctly.

Vocabulary:

transpiration
root hairs
lenticels
lignin
suberin

meristem
cambium
cortex
endodermis

Translocation
vascular bundles
xylem
tracheids
phloem
companion cells
cytoplasmic flow or streaming

pericycle
pith

Forces that move water:
root pressure
osmosis
active transport
transpiration pull
cohesion (Dixon-Joly Theory)
adhesion (on walls of ducts)

Objective 2. Given a diagram of a leaf x-section, he will identify structures and arrow flow-signs indicating the movement of gases through leaf tissue. 75%
(see lab 6)

Objective 3. On a test, from a list of statements, he will indicate structural differences to be found between xylem and phloem tissue. 70%

Objective 4. From his reading in the text and from lecture notes, the student will analyze the flow of water up xylem tubules and indicate the forces that move water in each part of the plant. 60%

Objective 5. He will be able to choose from a list of statements, those by which food materials are moved in the phloem. 80%

Objective 6. In the lab, he will be able to identify tissues in root and stem cross sections and relate structure to the function of each. (lab 5) 75%

14. The student will understand that the organism's activity, size, and habitat determine the nature of the digestive process; and that hydrolysis is characteristic of digestion inside or outside of cells.

Objective 1. From a list of vocabulary words drawn from Chapter 10, the student will match each with its correct definition. 80%

Vocabulary:

Extracellular digestion
saprophyte
amylase
food vacuole

Food tube
ingestion
Intracellular digestion
Stomach
HCl

pyloric sphincter
duodenum
Filter feeding
gizzard

Objective 2: He will be able to classify the kinds of digestive systems found in organisms and from a list of items, match each type with its correct characteristic statement. 70%

Test sample: From the list of items, chose the one that best describes the collection of food or intake of materials in organisms.

1) intracellular digestion
2) active seizing of prey plus intra cellular digestion
3) filter feeding
4) seizing with external digestion
5) ingestion of fluid foods
6) digestion using symbiotic organisms

1_____digestion as found in the porifera.
2_____a mucus film is swept into the mouth bearing tiny particles with it.
3_____plant juices are ingested by aphids (see p. 262)
4_____cellulose is broken down by bacteria in the rumen.
5_____solid food masses are mechanically processed in a gizzard.

Objective 3. He will analyse the movement of food through the digestive tract of man and from a list of statements concerning specialization of regions in this tract, match each with its correct function. 70%

Test sample:

list of items:
1. mouth and teeth
2. stomach
3. liver
4. pancreas
5. large intestine

1_____bile is secreted to emulsify fats
2_____trypsinogen is released to the small intestine
3_____large food masses are mechanically reduced to smaller particles.
4_____HCl and pepsin begin protein digestion.

15. Goal: The student will understand that respiration is the process by which useful energy is made available to cells by the breakdown of fuel (carbon containing) molecules within the cell.

Objective 1. Using a flow sheet as a guide, the student will be able to follow a molecule of glucose through the events of cellular respiration and note where the largest number of ATP molecules are formed. 60%

Objective 2. On a test, he will be able indicate which steps are part of the glycolytic cycle and which belong to the Krebs and cytochrome cycles. 60%

Objective 3. He will be able to distinguish between fermentation and aerobic respiration so that he can match the end products of each with the correct process; and indicate the alternate acceptor for H ion in event of oxygen debt in human muscle. 50%

16. Goal: The student will understand that the method of gas transport and exchange in animals, again, depends upon the size of the animal and upon its habitat.

Objective 1. The student will learn the vocabulary selected from p. 205-209; and from Chapter 13, so that on a test, he can match the word with the correct definition or example with 80% accuracy.

Vocabulary: gills
trachae
air sacs
spiracles
contraction of thorax
abdomen
book lungs
supplimentary respiratory organs
skin (amphibians)
air sac (birds)
lungs
nares
glottis
trachea
bronchi
bronchioles
alveoli
capillaries
diaphragm
medulla oblongata

Objective 2: He will be able to distinguish the major characteristics of devices used by organisms for extracting oxygen from moist and from dry land environments s o that on a test, he can match respiratory structures with functions. 70%

Objective 3: He will be able to contrast and compare the devices used by organisms to ventilate the respiratory surfaces with similar or comparable structures in man so that he can match these on a test with 70% accuracy.

17. Goal: The student will understant that the methods by which materials are treated and transported in circulatory systems depend on 1) the shape and size of the organism; 2) its activity rate, and 3) the habitat in which it lives.

Objective 1. The student will learn the vocabulary selected from Chapter 14 and developed in lecture, so that on a test, he can match the word with the correct example or definition with 80 % accuracy.

Vocabulary hemoglobin
hemocoel
"open" circulatory system
red corpuscles
white corpuscles
platelets

Auricle
ventricle
capillaries
artery
vein
"closed" circulatory system
pulmonary circulation
systemic circulation
coronary arteries--system
plasma
serum albumin
serum globulin
fibrinogen
lymph
S-A node
autonomic nervous system

vasodilation vaso constriction bradycardia in diving animals
Counter-current systems and special adaptations to cold
(lecture supplimant)

Objective 2: He will be able to distinguish the major characteristics of open and of closed circulatory systems so that he can match structure with function and make comparisons between them from a list of statements or from diagram interpretation. p 236-7 and lecture 70%

Objective 3: He will be able to compare the circulation pathway and gas content of the blood in a 2-chambered fish heart, a 3-chambered frog heart and a 4-chambered bird or mammal heart, given simple outline diagrams representing these pumping organs (lecture--board diagrams) Text: p. 238-868 80%

Objective 4: He will be able to distinguish between blood and plasma, so that, given a flow diagram (see p 238) he can choose the functions of each from a list of statements. 70%

Objective 5: He will be able to characterize bradycardia by choosing from a list those statements that do or do not apply (lecture and p 243) 70%

Objective 6: He will be able to interpret a flow diagram of the countercurrent or Counter-current heat exchange mechanisms in cold-adapted vertebrates and indicate 1) direction of the blood; 2) the energy exchange 3) the temperature gradients involved. (lecture material) How does vasoconstriction function in such a system? Vasodilation? 70%

10. Goal: The student will understand that organisms maintain their internal environment within narrow limits by regulating inputs and loss of necessary materials and despite rapid changes in the external and internal environment.

Objective 1: The student will learn the vocabulary developed in lecture and from selected text readings, so that on a test, he can match the word with the correct example or definition with 80% accuracy.

Vocabulary

Homeostasis: steady-state control
stress (internal, external)
stimulus
receiver
sensory pathway
modulator
motor pathway
effect
response

information flow (direction)
feedback (direction)
overload
neurosis

-- terms dealing with communications model

Objective 2: The student will be able to interpret the model for information flow through a steady-state system and match characteristic statements about the function of each of its parts and their relationship to the whole.

try 80% on this

19. Goal: The student will understand that most of the regulatory mechanisms involved in homeostasis involve interactions of chemical and neural coordinating systems.

Objective 1: The student will learn the vocabulary relating to the homeostatic control of CO_2 level in the blood and of osmoregulation of water and salts. 80%

Chapter 16

Vocabulary
nephron
Bowman's capsule
glomerulus
proximal tubule
Loop of Henle
distal tubule
collecting duct
urine
hypothalamus
posterior pituitary
vasopressin
stimulate
inhibit

Objective 2: On a test, he can match statements concerning a vertebrate nephron with the functions of the various specialized parts of any osmoregulatory system. (p 268-270) (Area of:1) Massive intake; 2) massive return of most materials 3) selective adjustment of waste products 4) final water uptake 5) storage). 60%

Objective 3: Similarly, from the text (p 266-67) and from the laboratory dissection, he can relate statements concerning the earthworm excretory system to the above list of specialized areas. 60%

Objective 4: Given representative flow diagrams of steady-state control of blood gases and of osmoregulation of water content in the blood, the student will be able to identify the chemical and neural pathways of interaction (stimulus and inhibition of activities) on a test with 70% accuracy.

20. Goal: The student will understand that chemical coordinating mechanisms control activities at all levels from the cell to the population.

These chemical agents are either carried by fluids or move through the environment.

The amount of the hormone is usually controlled by some aspect of the very process that it controls: by FEED BACK.

Objective 1: The student will learn the vocabulary from selected and noted sections of the text and from the lecture, so that on a test, he can match the word with the correct example or definition with 80% accuracy.

Vocabulary: endocrine glands
neuro-endocrine substances
hormones (p 284 in part)
neurosecretory center
neurohemal or storage organ
target organs
ductless

Vocabulary continued: (use pages 497-501 for terms here)

ovary
testis
follicle cells
estrogens
interstitial cells
androgens (testosterone)
follicular phase
luteal phase
corpus luteum
progesterone

pituitary (anterior lobe)
Gonadotropic hormones
FSH
LH

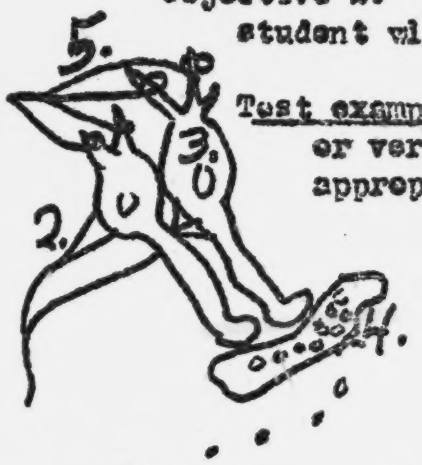
hypothalamus (neurosecretory center)
environmental factors
daylength . . . increasing, and decreasing.
rainfall
plumage and courtship activities

Pheromone
releaser effect (see p 387 for another example)
primer effect

chemical trail
alarm reaction
sex attractants
Gyp-lure & "Operation Confusion"

Interorganismic control:
Phytotoxic materials
sex determinism in slipper shells

Objective 2: Given a model diagram of a chemical and neural coordinating system, the student will be able to relate structures with functions with 70% accuracy.

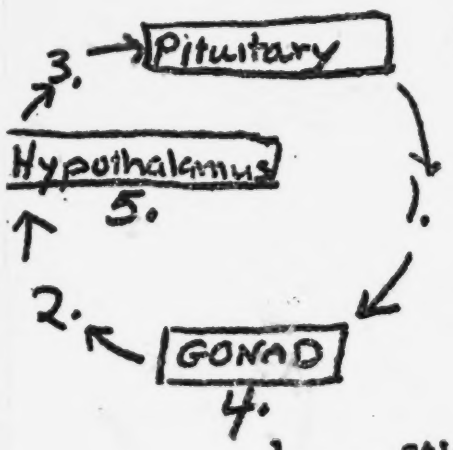


Test example: This is a diagram of a neurosecretory center of either invertebrate or vertebrate animals. Match each of the statements below with the appropriate numbered item.

Mark 1) if the statement is most true of structure 1.
Mark 2) if most true of structure 2
Mark 3) if most true of structure 3
Mark 4) if most true of structure 4
Mark 5) if most true of structure 5

1_____indicates a feedback stimulus
2_____would be the anterior pituitary in the vertebrate reproductive cycle
3_____would be the posterior pituitary in the osmoregulation of water content of the blood
4_____would represent the hypothalamus in both 2 and 5 above
5_____indicates an input nerve stimulus to the center.

Objective 3: Given a flow diagram of neural and chemical control of reproductive activity, the student can predict the effect of stimulation or inhibition in terms of reproductive activity of the organism, at any stage in the cycle.



Test sample: Match the correct item with each statement.

Mark 1 if the result of the statement is immediately true of 1.
Mark 2 " " " is most immediately true of 2
Mark 3 " " " " " " " " " 3
Mark 4 " " " " " " " " " 4
Mark 5 " " " " " " " " " 5

1_____stimulation occurs here if daylength begins to increase
2_____stimulation occurs here if FSH and LH level rises
3_____aggressive male behavior is attributable to this
4_____eggs develop here
5_____Birth control pills act here to inhibit ovulation in man

21. Goal: The student will understand that neural coordinating mechanisms are found in most multicellular animals and are characterized structurally by specialized cells: Neurons and Receptors.

Objective 1: The student will learn the vocabulary developed in lecture and from selected text readings, so that on a test, he can match the word with the correct definition 8 out of 10 times.

Vocabulary (CHAPTER 19)

conductor
sensory neuron
association neuron
effector

chemoreceptors:
Olfactory neuron
olfactory lobe
taste bud

echo-location in ba
tragus
ultrasonic sound

photoreceptors:
sclerotic coat
choroid coat
retina
lens
accomodation
focus

rods
rhodopsin
retinene
opsin

night adaptations
slit pupils
tapetum lucidum
eyeshine

cones
fovea
color vision

Meghanoreceptors:
tympanic membrane
cochlea
sound vibrations
frequency
intensity
cycles per second

Objective 2: The student will be able to characterize each of the 3 components of nervous coordination so that he can match each with its correct function from a list of statements. 75%

Objective 3: He will learn the anatomical basis for chemoreception (in man, fishes, reptiles) so that, given a numbered diagram, he can analyze the function of the component parts of these receptors. 65%

Objective 4: He will be able to explain the role of chemoreception in the migration of salmon from the home stream to the sea and back again so that, given a list of statements describing events in these migrations, he can distinguish those that do from those that do not apply. 65%

Objective 5: He will be able to interpret a generalized model of a vertebrate eye so that he can match structure with function. 65%

Objective 6: The student will be able to distinguish between night adapted eyes and daytime adapted eyes so that on a test he can match descriptive statements with each of these types. 65%

Objective 7: He will understand the major visual adaptations to space and motion among animals so that he will be able to match adaptations with animal groups. 65%

Objective 8: He will understand a generalized diagram of the vertebrate ear, so that, given a list of descriptive statements, he can match structure with function. 65%

Objective 9: The student will be able to apply the basic principles of sound reception to echolocation and orientation in bats, oil birds, & porpoises, so that on a test, he can indicate whether or not each descriptive statement does or does not apply to such typical phases of echolocation as 1) "Search Phase" 2) "Approach phase"; 3) "Terminal or Kill Phase", etc.

22. Goal: The student will understand that a nerve impulse is a depolarization and repolarization of a neuron that occurs sequentially along a cell.

Objective 1: The student will learn the vocabulary drawn from Chapter 20 so that he can match each word with its correct example or definition with 80% accuracy.

Vocabulary:

cell body
dendrites
axon
end brush
myelin sheath
ganglia

membrane potential or resting potential
depolarization
repolarization
action potential
sodium pump

threshold
"all or nothing" response
refractory period

Objective 2: The student will be able to describe the chain of events that constitute the movement of an impulse along a nerve fiber. Given a diagram and a list of statements, he can select those that do or do not apply.

23. Goal: The student will understand that chemicals produced by the ends of nerve cells facilitate the passage of the impulse between nerve fibers.

Objective 1: The student will learn the vocabulary of synaptic transmission (Chapter 20) so that on a test he can match word with example or definition 80%

Vocabulary:

synapse
chemical transmitter

acetylcholine
cholinesterase

Objective 2: The student will be able to analyze the events in synaptic transmission and distinguish between those events that are under neural control and those that are under chemical control 65%

Objective 3: The student will be able to trace the path of a simple reflex, as the "knee jerk" through the Reflex Arc (p 349), so that on a test, he can match statements descriptive of the events with each of the appropriate structures involved: 1) proprioreceptor 2) sensory neuron 3) association neuron 4) motor neuron 5) effector.

Objective 4: Pages 372 to top of 373: He will relate the events he has mastered in electrical transmission along a neuron with the depolarization and repolarization events in skeletal muscle, so that he can indicate, from a list of statements, those that do and do not apply.

Objective 9: The student will be able to apply the basic principles of sound reception to echolocation and orientation in bats, oil birds, & porpoises, so that on a test, he can indicate whether or not each descriptive statement does or does not apply to such typical phases of echolocation as 1) "Scarch Phase" 2) "Approach phase"; 3) "Terminal or Kill Phase", etc.

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Vocabulary:

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Objective 4: Pages 372 to top of 373: He will relate the events he has mastered in electrical transmission along a neuron with the depolarization and repolarizatio events in skeletal muscle, so that he can indicate, from a list of statements, those that do and do not apply.

Goal 24: The student will understand that asexual reproduction is characterized by mitosis.

Objective 1. Given a series of steps in mitosis of a single cell, the student will be able to arrange them in order of begining to end result. 60% if begining and end result are correct; 40 percentage points for correct sequence of intermediate steps.

Test sample: Each of the following drawings represents a stage in mitotic cell division. Order the correct sequence.

1._____
2._____
3._____
4._____

1. 2. 3. 4.

Objective 2. In the laboratory, he will be able to recognize and name stages of cell mitosis from slides of onion root tip and young whitefish embryo under conditions of a practicum exam. (See Manual Exercise 3; page 11.)

Objective 3. Given a series of statements concerning events in mitosis, the student can match each with the correct mitotic stage.

Test sample.

Match each of the statements below with one of the given items.

Items: 1) Prophase
2) Metaphase
3) Anaphase
4) Telophase
5) Interphase

1) DNA is replicated.
2__ Chromosomes meet at midline.
3__ Two daughter cells are formed
4__ Chromosomes thicken, shorten, become visible and nuclear membrane disappears.

Goal 25: The student will understand that sexual reproduction may be characterized by meiosis and fertilization.

Objective 1. He will review the events in meiosis and gamete production so that on a test he can designate which stage results in:

1) reduction of chromosome number;
2) when the unique pairing at synapsis of homologous chromosomes occurs;
3) when crossing over occurs and what is its result;
4) when random assortemnt or shuffling of parental chromosomes occurs at the equatorial plate
5) when segregation of homologous chromosomes occurs and one member of each pair goes off to opposite ends of the cell
6) production of 4 daughter cells; (that will eventually mature and become gametes)

Objectlve 2. On an exam, the student can write a short summary contrasting the advantages and disadvantages of asexual with sexual reproduction.

Goal 26 : The student will understand that Genetics is the study of the transmission and expression of traits in successive generations of organisms.

Objective 1. He will learn vocabulary terms relating to the study of genetics with 80% accuracy. See lab manual p. 83.

Objective 2. He will relate Mendel's findings(the existence of discrete hereditary units and some of his simpler interactions including dominance, segregation, and recombination)--to meiosis and be able to solve a variety of problems concerning single factor genetic crosses. See lab man. p. 93; questions 1-10. 75%

Objective 3. He will follow the transmission and expression of 2 hereditary traits at the same time and be able to solve genetic problems involving dihybrid crosses. See lab man. p 91; problems 3-5; and page 94, problems 11, 12, 13. 60%

Objective 4. He will be able to apply knowledge of the transmission of hereditary traits in human beings to hypothetical problems.presented on the exam. 60%

Objective 5. He will be able to predict the transmission of sex-linked characteristics in a variety of problems in human inheritance. See p. 92, lab man., prob. 7. and selected problems from lecture section. 60%

Goal 27: The student will understand that selection adapts a population to its environment by choosing the fittest individuals available. See Chapter 32. (Chapter 31 is optional reading; the instructor considers Evolution to be a fact)

Objective 1. The student will learn vocabulary terms selected from Chapter 32

Vocabluary:

natural selection
fitness
adaptation
survival value
sexual selection
family size
crossing over
random assortment
outbreeding
mutation
gene pool

Objective 2. He will be able to identify the causes of selection pressure and be able to contrast them with the effects of relaxed selection pressure on populations of organisms.

Objective 3. He will be able to define the nature of morphological, physiological, and behavioral adaptation and be able to match each of these with items from a list of selected examples.

Goal 28: The student will understand that populations adapted to different environments may undergo speciation if they are isolated from one another for a sufficient period of time.

Objective 1. Using the example of Darwin's finches on the Galapagos Islands, the student will be able to interpret the roleof isolation and of increased ecological opportunity on these birds that resulted in radiation into 14 new species in different ecological niches.

BIOLOGY OBJECTIVES: SET # 5

Unit I — The Historical and Present Position of Biology as a Scientific Discipline.

Topics:		Class Meetings Involved
a)	Course Introduction	1
b)	Classical Biology - the thoughts and men.	1
c)	Modern biology- integration of the sciences.	1
d)	Scientific thought and experimental method.	2

Objectives

Goal 1: The student will have knowledge of the historical background of classical biology, and of the rapid advances and discoveries which have recently been made in molecular biology and biochemistry.

Objective

1.* Given a list of important biologists he will describe in 20 words or less the major experimental discovery of each. 70

2. Using available library media he will explain the techniques now being used to uncover the basic processes of life by writing three fifty word summaries of recent experiments (1960-1966) in biology. 100

3.* He will discuss in 30 words or less for each the importance of biochemistry, biophysics, and physical chemistry to the study of biology. 80

Goal 2: The student will understand the scientific method of inquirey.

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* Normal test conditions.

Objective 4. He will write an outline one page in length, due within one week. Given a copy of a recent publication in biology, he will at home, outline the basic procedures used in the experiment, and graphically represent all the data presented in the results of the experiment. He will not be concerned with conclusion drawn from the data. 100

5. The student will be given a data sheet in class collected from an animal nutrition study. Ideas of how the experiment was designed, how data was collected and what conclusions can be drawn from the data will be discussed by the students and instructor. He will within three weeks write a 200-250 word scientific paper containing a logical approach for presentation of the data so that his conclusions are substantiated. 100

Unit II The Characteristics of Living Things.

Topics:		Class Meetings Involved
a)	Non-living and living things. The origin of life.	1
b)	The similarity of living things.	1
c)	The cell, structure and function.	2
d)	The cell, metabolism.	4
e)	The cell, physical processes, energy.	1

Objectives

Goal 1: The student will understand the chemical requirements of living things.

Objective 1.* He will list the four classes of chemical compounds basic to all life, and define in 20 words or less the function of each class. 90

2.* He will compare in 50 words or less the position of virus, bacteriophage, bacteria, and complex plant or animal forms; as to their similarities and differences, as possible life forms. 100

Goal 2: The student will understand the basic principles of life processes at the cellular level.

Objective 3.* Given a diagram of a cell he will correctly label all the parts indicated, and discuss the function of each in 20 words or less. 70

4.* He will define in 20 words or less the terms: differentiation, homeostasis, anabolism, catabolism. 60

5.* He will describe by use of diagram or chemical equation the processes of energy capture: photosynthesis, energy release, and expenditure; and energy utilization: synthesis of cell components. 70

6.* He will define four properties of an enzyme, and apply the enzyme principle to control of cellular metabolism. 70

Unit III Cell Division and Reproduction.

Topics:		Class Meetings Involved
a)	Mitosis and Meiosis.	2
b)	The chromosome Theory-Mendalian principles.	2
c)	The gene and protein synthesis.	2
d)	Cell differentiation	1
e)	Reproductive cycles in the organism.	2

Objectives

Goal 1: The student will understand the processes of mitosis and meiosis.

Objective 1.* He will demonstrate diagramatically mitotic and meiotic division, and discuss in 30 words or less the importance of each. 80

2.* The student will define in 15 words or less for each, ten terms associated with genetics. 80

3.* He will, given a phenotype and genotype, each with two characteristics, determine the F_1 and F_2 progeny of a selfcross. 70

Goal 2: The student will understand the theory of one gene-one enzyme, and apply this to cell differentiation.

Objective 4.* He will in 50 words or less, and using diagrams, explain the one-gene-*one enzyme* theory and its control over cellular metabolism. 60

5.* He will describe the roll of nucleoproteins in cellular control by diagram and short descriptions. 60

Goal 3: The student will understand the basic reproductive cycles of plant and animal life.

Objective

6.* He will complete diagrams of two plant and two animal reproductive cycles. 80

7.* He will discuss in 75 words or less the difference between the haplophase and diplophase reproductive cycles, and give two examples of each. 80

Unit IV The Development of the Organism

Topics:		Class Meetings Involved
a)	External factors-assimilation and respiration.	1
b)	Internal factors-circulation and excretion.	1
c)	Hormones.	1
d)	Responsiveness and Behavior.	1

Objectives

Goal 1: The student will understand the processes of procuring needed materials and energy by the multi-cellular organism.

Objective 1.* He will discuss in 30 words or less the effect of size upon an organism, and give two examples of special features which must develop in large organisms, to overcome the difficulties created by size. 70

2.* He will define in 20 words or less respiration, and diagram the processes involved in the absorption, transport, storage and utilization of glucose. 70

3.* He will relate in a simple diagram and short discussion, the relationship between respiration and ATP production. 60

Goal 2: The student will be able to diagram the generalized circulatory system of a plant and animal.

Objective 4. He will discuss in 30 words or less the transpiration-cohesion-tension theory of water movement in plants, defining the part played by each factor. 80

5.* He will define in ten words or less for each the terms whole blood, plasma, serum, and fibrogen. 80

6.* He will list five materials being transported in the blood. 80

7.* Given a diagram of the human heart he will lable the parts indicated, and in 20 words or less discuss the pacemaker system. 60

Goal 3: The student will understand the function of of hormones in plants and animals.

Objective

8.* He will match six animal organs with the hormone formed by each, and process controlled by each. 60

9.* He will name three plant hormones, and in 30 words or less describe the function performed by each. 60

Unit V Evolution - The Diversity of Life

Topics:		Class Meetings Involved
a)	Genetics of populations.	1
b)	Natural selection.	1
c)	Adaptation.	1
d)	Principles of classification.	1
e)	Protists and simple plants.	1
f)	Complex plants.	2
g)	Animals.	2
h)	Mollusks, Arthropods, and Vertebrates.	3

Objectives

Goal 1: The student will understand the mechanisms of evolution.

Objective 1.* He will apply his knowledge of genetics to the process of evolution by stating the Hardy-Weinberg law in 50 words or less 80

2.* He will list four conditions which must by met if the Hardy-Weinberg Law is to hold, and state whether these conditions are met in real populations. 60

3.* He will define in 30 words or less what is meant by natural selection. 80

Goal 2: The student will equate evolution and adaptation.

Objective 4.* He will list the three major forms of adaptation, and list two examples of each with short explanations. 60

Goal 3: The student will understand the scientific method of classification.

Objective 5.* He will list in systematic hierarchical fashion the seven divisional terms used in biology from highest to lowest. 100

Goal 4: The student will understand the importance of protists and simple plants.

Objective 6.* He will discuss in 30 words or less for each, the importance of the bacteria, algae, protists, and fungi in mans present environment. 80

Goal 5: The student will understand the conditions necessary for land life, and apply this to the ways vascular plants have evolved.

Objective 7.* He will discuss in 50 words or less the four groups of early (primative) vascular plants, Included will be the differences between the four groups structurally and reproductively. 60

8.* He will distinguish the difference between gymnosperms and angiosperms, give two examples of each, and discuss the importance of each class to modern man. 80

Goal 6: The student will have knowledge of animal life.

Objective 9.* He will list, and discuss, the six areas of constrast between plants and animals. 80

10.* He will list eight of the eleven major animal phyla, and name a common animal in the eight chosen. 60

11.* He will apply the theories of evolution to the Mollusks, Arthropods, and Vertebrates; and diagram evolutionary trees for two of these animal phyla. 60

Unit VI Man and His Environment

		Class Meetings Involved
Topics: a)	The population and environment	2
b)	The organization of living communities	2
c)	Man in nature	4

Objectives

Goal 1: The student will have knowledge of the environment in which man is placed.

Objective 1.* He will list the five major cycles of materials found in nature, diagram each and discuss in 20 words or less the importance of each to man. 80

2.* He will define the following terms in 15 words or less for each: symbiosis, commensalism, mutualism, parasitism. 80

3.* He will discuss in 50 words or less two societies of animal life, comparing and contrasting them. 60

Goal 2: The student will be able to evaluate the extent of mans control over the natural environment, and propose directions and consequences of mans study of the biological world.

Objective 4. Outside of class he will write an annoted 150-200 words essay discussing mans polution of his environment. 100

5.* Given a list of four major endeavors biologists are now working on experimentally, he will chose three, and discuss in 30 words or less for each what the endeavor may lead to and the consequences upon man. 80